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INDEX-CONTENTS

	Page
Editorial	3
Dr. Graham—What Happens at Cathode?	4- 9
Detroit Dates Convention	9
K. Burgess-Zapon Co.—Story Lacquer	10-16
W. J. Schneider, R. & H. Co.—Cadmium	16-26
Cadmium vs. Zinc. Read by Geo. B. Hogaboom, Past President, A. E. S.	26-30
A. E. S. Page	34
Branch Notes	35-39
Applications, Elections, etc.	39
Directory Branches	40

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VOL. XVI FEBRUARY, 1929 No. 2

EDITORIAL

July 8, 9, 10, and 11 are the magic dates of 1929 and the City Detroit and State Michigan for the A. E. S. and Statler the hotel. Don't forget.

President E. Allen and his many committee members are forging right ahead with the plans to make this convention the best educational and practical session ever held by the A. E. S.

They are asking that each branch do their bit in getting enthusiasm worked up among their members, also that members get busy and name their papers, that the programs may contain conclusive evidence that this is your profession and you are the men who furnish the practical and scientific details that make progress in this art of electro deposition.

Remember the only recompense that these branches get from entertaining A. E. S. and its friends is the satisfaction of a job well done and only way to demonstrate this to their satisfaction, is to attend this annual event and bring your interested friends and platers with you ever remembering the greater the number the bigger the success.

The Detroit Branch secretary says that Detroit does lots of chromimum platings and many new wrinkles will be exhibited at the annual meeting. *So let us all be there.*

WHAT HAPPENS AT ANODE AND CATHODE

By Dr. A. K. Graham

(From Convention Proceedings)

"The reduction of energy consumption in the plating circuit has been the concern of electrical engineers for some years. Most attention has been focused upon the current capacity of the buss bars, the location of the plating tank with respect to the generators, and the proper relation of the capacity of the rheostat to the current and voltage requirements. With the advent of chromium plating where the energy consumed is unusually high, an analysis of how this energy is used within the solution is undoubtedly of interest and a similar study of the other kinds of plating might be profitable. For such an undertaking the assistance of the electrochemist must be sought because a knowledge of the fundamental principles of electrochemistry is essential.

"In attempting such an analysis consider a typical plating room circuit containing a six-volt generator D, an anode A, a plating bath B, a cathode C and a rheostat R. Such a circuit is illustrated in Figure 1. From D at 1 to D at 2 there is a pressure of six volts. There is a very small drop on pressure in the buss bar from D to A. At the anode A, a drop occurs as the current enters the solution. This is due to the anode polarization about which more will be said later. Through the solution B the pressure continues to fall. At the cathode A a further drop takes place; this is due to the cathode polarization which will also be discussed later on. The pressure loss in the buss bar from C to the rheostat R is very small. Through R, a large drop occurs, while the small drop in the buss bar from R back to the generator D at 2 finally reduces the voltage to zero.

"Reference to Figure 2 shows that in the case under consideration the total buss bar loss, i. e., the pressure drop, of 0.22 is small, which of course is as it should be. The drop in pressure from anode to cathode is the sum of the drop at the anode A (0.8 volt), the drop through the solution B (2.7 volts) and the drop at the cathode C (1.0 volt). The drop through the rheostat R (.28 volts) is the difference between the sum of all of the above values and six volts, the pressure of the generator.

"The energy consumed in the plating room determines the cost

of plating. This energy is the product of the voltage E, the current I and the time T. The

"1. Cost = Energy = $E \times 1 \times T$

plating actually accomplished, however, is determined by the current 1 multiplied by the time it flows, T. It is evident

"2. Plating " $1 \times T$

from equation (2) that, if the necessary current could be obtained without any voltage, E, plating could be carried on without the consumption of energy and hence at no cost. It is therefore desirable to plate with as low an energy consumption, at as low a voltage E, as possible.

"In this connection further reference to the illustration in Figure 2 shows that 4.5 volts are required across the plating tank, and the 1.5 excess voltage supplied by the generators is wasted. If it were possible to eliminate the combined pressure drops at both anode A and cathode C (1.8 volts) the plating voltage from A to C would then be the drop through the bath B or only 2.7 volts. This would be a forty per cent decrease in energy consumed and in plating cost. It is because the voltage drop at the electrodes has such an important bearing not only on the cost but also upon the actual control of the plating operation that what happens at the anode and cathode is of interest.

"In attempting to study the voltage drop at anode and cathode consider the simple case of the two platinum electrodes in a sulphuric acid solution. Figure 3 shows such a cell connected to a double throw switch but in such a manner that when the switch occupies position one (1) the cell is in a series with a dry cell, D, a rheostat, R, and a galvanometer, G. When the switch is closed at position two (2) the cell is short circuited directly through the galvanometer.

"If the switch S is closed in position one (1) and the rheostat adjusted so that the applied voltage V across the cell equals 1.23 volts, the galvanometer will show no deflection.

"If the applied voltage is now raised to any value above 1.23 volts and below 1.70 volts the galvanometer will give a sudden deflection in one direction indicating a flow of current and an invisible film of gas is believed to form at the electrodes. The current quickly drops to zero as this film builds up and the galvanometer pointer returns to its original position. If the switch S is now closed in position two (2) the cell is short circuited

through the galvanometer which will show a deflection equal to but in the reverse direction to the previous one. This small current resulting from the back electromotive force caused by the gas films quickly drops to the zero as the films are dissipated and the galvan again returns to its neutral position.

"If the switch S is returned to position one (1) and the applied voltage is now raised to 1.7 volts the galvanometer is permanently deflected and a small current continues to flow.

"The theoretical decomposition voltage of water is about 1.23 volts; yet it was found necessary to raise the applied voltage to 1.7 volts before visible electrolysis of the solution and a continuous flow of current took place. Neglecting the small ohmic resistance of the solutions the difference between these two values is 0.47 volt the pressure used in overcoming the resistance to the flow of the current offered by the gas films formed on both electrodes. This polarization, as it is called, may be defined as the difference between the theoretical and the actual applied voltage required to maintain continuous electrolysis.

"Two kinds of polarization are possible, namely (a) concentration polarization and (b) chemical polarization. (a) concentration polarization is affected by (1) the speed with which the ions move; (2) nature of the ion discharge (whether gas or metal) and the (3) current density. (4) temperature and (5) agitation employed. The specific effect of any one of these variables depends upon the actual case under consideration. In general the polarization of an electrode decreases the greater the speed of the ion approaching it, the lower, the current density, the higher the temperature and the greater the agitation.

"(b) Chemical polarization is believed to vary with (1) the velocity of ionization, (2) the resistance to the transfer of the electric charge and (3) the nature of the electron reaction.

"Anodic Behavior. An anode may be (1) completely soluble, (2) partially soluble or (3) entirely insoluble. In no case under commercial conditions will an anode be entirely free from polarization. One that is completely soluble may upon electrolysis be accompanied by both concentration and chemical polarization.

"With an anode that is partially soluble or entirely insoluble there may be both concentration and chemical polarization and in addition a tendency for a film to form on the anode, making the solution of the metal still more difficult. Passivity, as this

tendency is called, may be (a) mechanical or (b) chemical, in nature.

"With mechanical passivity the film upon the anode is usually visible as would be the case where green basic nickel salt is formed, when a nickel solution is alkaline. With chemical passivity there may be no visible film; a simple illustration of this can be given by dipping a piece of iron in concentrated nitric acid and then in a copper sulphate solution. No copper is precipitated upon its surface as would be the case were the acid dip omitted.

"This behavior is believed to be due to the formation of an invisible film of oxide by the nitric acid which makes the iron behave like a more noble metal. Such a film is readily formed upon exposing nickel or chromium to the air. The resulting passivity would cause the metal, if used as an electrode, to behave abnormally, thus affecting the polarization.

"Decomposition Voltage. The lowest applied voltage that will initiate continuous electrolysis of a sulphuric acid solution using platinum electrodes is roughly the decomposition voltage of the solution. This has been shown to be about 1.7 volts. If the platinum anode is replaced with lead the decomposition voltage would be greater than the above value. This effect is spoken of as over-voltage.

"Over-voltage. Over-voltage may occur at either anode or cathode. The oxygen over-voltage of a metal is the voltage required to liberate oxygen at an anode of the metal in excess of the equilibrium value. Similarly the hydrogen over-voltage of a metal is the voltage required to liberate hydrogen on a cathode of the metal in excess of the equilibrium value.

"The effect of over-voltage is to increase the pressure drop at the electrode before gas evolution takes place, so that it may be regarded in the same sense as polarization. It will vary with (1) the electrode material being high on lead, a medium value on copper and a relatively low value on iron or steel. The (2) current density, (3) temperature and (4) time the current flows, all affect the over-voltage.

"Hydrogen over-voltage is of value to chromium deposition. In order to deposit metal from a chromic acid bath the chromic acid must be reduced to metallic chromium. The hydrogen available affects this reduction. Furthermore, the higher the hydrogen over-voltage of the cathode, the more readily will the reduction to

metallic chromium take place. It is for this reason that a surface of copper is easier to cover with chromium than one of steel.

"Oxygen over-voltage is also of exceptional value in chromium deposition from a chromic acid solution. Oxygen liberated at the anode oxidizes chromic salt to chromic acid, thus reducing the tendency for chromium dichromate to accumulate in the plating bath. The higher the oxygen over-voltage of the anode the more readily will the chromic salt be oxidized and the less tendency will there be for it to accumulate. This is one reason that lead, which has an exceptionally high oxygen over-voltage is favored as an anode material.

"In all other plating operations not requiring oxidation or reduction, over-voltage will merely affect the polarization.

"*Polarization*. Haring has shown that solutions giving the greatest increase in cathode polarization for a small increase in current density have the best throwing power. In general solutions giving high cathode polarization have good throwing power. Advantage is taken of this fact in nickel plating zinc or die castings, where the solutions most commonly employed have a low metal concentration and sufficient conductivity to permit the use of high current densities. Both of these factors increase cathode polarization.

"The work of Blum and Rawdon, Kohleschutler, and the author, has shown that the structure of electro-deposited metal must be attributed to or accompanied by a change in cathode polarization. Recently Mr. Geo. B. Hogaboom in his lecture on 'Crystal Structure of Metals' has shown that the anode can affect the character of the deposited metal. It is reasonable to conclude that anything affecting anode behavior such as anode polarization will under certain conditions influence the effect of the anode upon the structure of the cathode. Polarization at either electrode, therefore, may influence the character of the deposit.

"It has already been shown that the polarization at both electrodes represented forty (40) per cent of the applied voltage shows this even more clearly in the case of chromium deposition. The anode and cathode polarization, shaded areas A and C respectively, increase rapidly as the current density is raised. If depositions could be accomplished without this polarization, the voltage required would correspond to the values between the two lines forming the area B. This would equal the decomposition

voltage of the bath plus the IR drop, the loss due to the ohmic resistance of the solution. The higher cost of chromium plating, is largely due to the polarization accompanying it.

"While it is not possible to eliminate polarization in the chromic acid plating bath, excessive chemical polarization due to the formation of lead chromate on lead anodes can be prevented. The best practice is to always keep the current on while the anodes are in the solution. This is done by hanging a dummy or a porous cup permanently from the cathode rod and by always removing the anodes at night before shutting down the generator. In the morning the generator should be started first and then the anodes, after scrubbing to remove the chromate acid to expose a fresh lead surface, should be hung in the solution. By so doing, the maintenance of the chromium solution is improved and the possibility of reversing the field of the generator due to the back electromotive force sometimes developed, is eliminated.

"Any anode that polarizes excessively will have a lower efficiency, the metal concentration of the solution will thus decrease, more frequent adjustment of the solution composition will be required, a less uniform product will be obtained and more energy will be used in deposition.

"All of these factors increase the cost of production. A careful analysis must be made to determine to what extent this is so, but if this paper serves to focus attention upon such an analysis its object will have been fulfilled."

LEST WE FORGET

OUR ANNUAL MEET

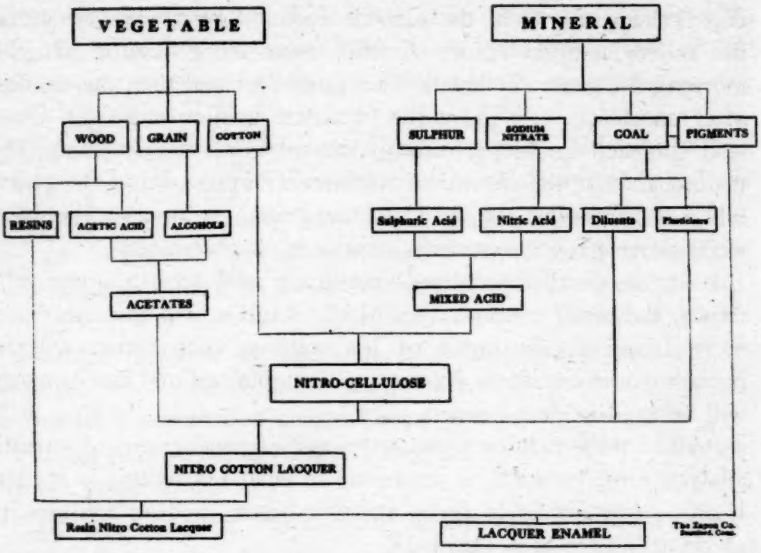
July 8, 9, 10, 11, 1929

Detroit, Michigan

THE STORY OF LACQUER

By Kenneth E. Burgess, Zapon Lacquer Co., Stamford, Conn.

Because I thought that you, being large users of lacquer, would be interested in its derivation, the control of its manufacturing and the physical and chemical nature of lacquer which determine its fundamental behavior.



"Lacquer and lacquer enamels consist essentially of five divisions: 1. Nitrocellulose; 2. solvents and diluents; 3. resins; 4. plasticizers; 5. pigments or dyes.

"Nitrocotton, whether the most common nitro cellulose, is made by treating cotton linters with a mixture of nitric and sulphuric acid. The cotton linters are derived from the small fibers adhering to the cotton seed after the long fiber has been picked off by the cotton gin. The seeds are sent to the cotton seed mill where these short fibers are shaved off by machines resembling a many bladed band saw.

"The linters are delivered in bales and are treated with a caustic solution to remove traces of oil and woody fiber, and then with clorine compounds to bleach them to whiteness.

"Sulphuric acid is manufactured from pure sulphur. The principal source of sulphur is the large sulphur beds around the Gulf

of Mexico. The sulphur occurs in deep lying beds and is mined in an ingenious manner by pumping superheated steam down to the bed and forcing the resultant liquid sulphur to the surface.

"Liquid sulphur is run into large bins where it hardens and is afterwards broken up for shipment, north. The sulphur is burned in a large rotary converter and the resultant sulphur dioxide purified through towers and asbestos-packed columns. It is then forced over compartments containing platinum precipitated on magnesium sulphate. At high temperatures the platinum has the ability to cause the sulphur dioxide to unite with additional oxygen, forming sulphur trioxide. This sulphur trioxide gas is then absorbed in weak sulphuric acid, bring the strength of the resultant sulphuric acid up to ninety eight to 110% H_2SO_4.

"The most common source of nitric acid is from sodium nitrate or Chile salt peter. This material occurs in the arid rainless regions of South America. The material is leached out, crystallized, and shipped north for consumption.

"The most common method is to treat a large amount of nitric with an equal amount of sulphuric acid ninety-eight per cent, in a large cast iron retort. Retort is either oil or coal fired.

"The nitric oxide vapors distill off and are condensed either in chemical or glassware, or in the many acid-resisting from alloy systems. Nitric acid is delivered to large tanks containing sulphuric, where it is thoroughly mixed with the sulphuric, forming the mixed acid.

"The nitrating of the cotton linters is a very exact chemical operation. The temperature, time, total acidity of the acid, and the ratio of the nitric to the sulphuric must be accurately determined and maintained.

"Recently there has been a great advance in the manufacture of nitric acid from the nitrogen of the air. The nitrocotton is introduced in an agitated nitrating tank holding about 1500 lbs. of acid to thirty-five pounds of cotton. It is nitrated usually for about twenty-five minutes, and the average temperature is 35° C. After nitration the entire charge is dropped into a centrifugal where the excess acid is extracted. The nitrated cotton is then dropped into a drowning tank where the remaining acid is completely diluted so that no further action takes place. It is then transferred to large wooden tubs where repeated boilings break

down the unstaple compounds and give a staple nitrocellulose. These boiling tubs are compounded in a larger blending tub to give a batch of uniform viscosity, stability, nitrogen, content, etc.

"The nitrocotton is pumped from the boiling tubs to a battery of centrifugals where the excess water is extracted. Before its use in lacquer, it is necessary that this water be removed. Drying the nitrocotton would affect this nicely but, of course, this is extremely dangerous. The standard practice is to replace the water with alcohol and can be carried out either in a hydraulic press or in an extraction tub. Hydraulic presses compress the water-wet cotton, forcing out a large portion of the water. While still under pressure, denatured alcohol is pumped through the nitrocotton mass and the alcohol thoroughly displaces the water.

"A simpler method is to fill the tub with the nitrocotton and run in alcohol until the whole mass is saturated and a layer of perhaps two feet of pure alcohol above the nitrocotton. The bottom drain is then opened and the liquid then run off, carrying the water with it and leaving the nitrocotton wet with pure alcohol. The excess alcohol is once again extracted in the centrifugals. The nitrocotton is now ready for delivery to the lacquer plant.

"The simplest lacquer consists of a nitrocotton dissolved in a solvent, which brings us to the second division. The principal solvents are acetates of the various alcohols. That is, ethyl acetate, butyl acetate and amyl acetate. These acetates are made by the action of acetic acid upon the corresponding alcohol, process of which is either intermittent or continuous.

"The usual acetic acid is the calcium acetate derived by treating pyroligneous acid, obtained from the distillation of hard wood with milk of lime. This calcium acetate is acted on by sulphuric acid in the presence of the alcohol, with the addition of heat. The sulphuric acid liberates the acetic acid, which unites the alcohol, forming the corresponding acetate. This acetate is further refined for color and constant boiling range.

"Other well known solvents are acetone derived from wood products and methyl alcohol derived from the same source. Recently a number of synthetic products are finding favor in lacquer manufacture.

"In making lacquer, however, it is not necessary to use 100% solvent, as twenty-five to fifty per cent solvent is sufficient to disperse the required nitrocotton. Consequently known solvents

or diluents are employed. These consist mainly of the alcohols such as ethyl alcohol or butyl alcohol and the hydro carbon series such as benzol or toluol.

"A lacquer made of nitrocotton and solvent only gives a tough film but with small building power and comparatively low adhesion. In order to obtain additional building power and additional gloss it is customary to make a mixed lacquer by adding solutions of certain resins to the nitrocotton lacquer. These resins are in the main the common resins in varnish manufacture, such as copal, Kauri, Damar, and shellac. In addition there have been perfected recently, a large number of synthetic resins having as their base, rosin glycerin phthatia anhydride.

"Resins are generally hardened residue from the sap of certain bushes or trees. Shellac, however, has a rather intersting history being the exudation of a certain type of insect, which feeds upon the sap of a tree in India. The insect in certain seasons of the year feeds very rapidly and throws off this exudation in the form of a hard crust. This crust hardens to the trees, is broken up, washed, remelted and shipped to this country as the shellac of commerce.

"Kauri and copal resins are the exudation of prehistoric trees; this exudation having lain buried in the ground for many thousands of years and is now mined principally in Australia and New Zealand.

"These various resins impart additional body and building power without noticeably increasing the viscosity and gives greater gloss and adhesion. For many purposes, however, these resins for nitrocotton lacquers are too brittle and a plasticizer is added as a softener. These plasticizers are usually of two types, one a latent solvent with pyroxylin, and the other usually an oil type which forms colloid with the nitrocotton, giving additional flexibility. The principal ones in use are Lindol and Dibutyl phthalate and in the oil class, Castor Oil.

"In making an enamel, pigments are ground in the lacquer to give covering power and coloring. There are three methods of grinding pigments, in a pebble mill, a Buhr mill and the steel roller mill. The pebble mill is a cylindrical steel jacket lined on sides and ends with porcelain bricks and filled half full of hard flint pebbles. The cylinder revolves on trunnions and the material is ground by the many contacts formed by the pebbles rolling

against each other and against the porcelain sides. This method is particularly suited to lacquer as the cylinder can be closed and there is no loss by evaporation.

"The Buhr mill operates by the grinding action of two stone mills revolving against each other in counter directions. This method gives good fineness but care must be taken to prevent evaporation. Steel roller mills are similar to the Buhr mills except that there are usually three steel rolls revolving each against the other in counter directions, and the material is ground at the point of contact.

"Having traced the flow sheet of lacquer it perhaps would be interesting to discuss the physical, chemical, nature of the finished product.

"When nitrocotton is added to a solvent, it rapidly disappears and it is only natural curiosity to ask ourselves in what state the nitrocotton now exists. We have seen it as a white fluffy material and now it has entirely disappeared, leaving a clear colorless solution. Evidently nitrocotton has been dispersed into particles too small to be visible to the eye. We at once wonder just how small these particles are, and what is the ultimate size of which it is possible to conceive.

"The smallest particle we can conceive must have a front, back, top and bottom, and therefore be capable of further division. The smallest material unit whose existence as separate entities thus far have been experimentally proven are the electrons, the individual particles of negative electricity which revolve around protons or individual particles of positive electricity which combined make the atom. The combinations of atoms form the molecule and the combination of molecules form the various states of matter with which we are more readily familiar. The size of protons and electrons are so small that it is difficult to conceive them. It can best be expressed by Professor Millikans' statement that the number of electrons passing in a single second through an ordinary incandescent bulb is so great that it would take two and a half million people counting continuously day and night at the rate of two a second about 20,000 years to complete the task.

"The atom is comparatively much larger but still in the realms of the unseen, the size of an atom being 1/10 to 6/.0 of a millimi-

cron; a millimicron being one-millionth of a millimeter. A molecule is 2/10 of five millimicrons.

"The smallest particle visible to the naked eye is about 20,000 millimicrons so that you see between the size of a molecule and the visible particle there is an extremely wide range in size.

"If you dissolve salt or your more familiar nickel chloride you get a solution of certain definite physical characteristics, the principal one being its electrical conductivity. This conductivity being due to the fact that the dispersion of the solid nickel chloride has gone so far that the particles are dispersed to an atom or an ion size. On the other hand, a solution of sugar dissolved in water is not a good conductor of electricity because it has only been dispersed to the molecular size.

"These are the two general types of dispersion and these dispersions have very definite characteristics dependent mathematically upon the amount of material dispersed in the solution. However, as we stated before, there is a wide range in size of particles between the limit of visibility and the molecular dispersion and it is in this range that the nitrocotton lacquer falls.

"Nitrocotton dispersion in solvent does not reach the molecular dispersion but remains in that space mentioned before, and which has been given the name of 'colloidal' state of matter. Unfortunately colloidal state of matter is not as definite in its characteristics as the other states, the principal difficulty being in viscosity. The viscosity of a nitrocotton dispersion is not at all dependent on the amount of ntirocotton dispersed in solvent. A one ounce nitrocotton solution may have the same viscosity as a ten ounce provided the two nitrocottons have been nitrated with this in mind.

"As we stated before, the control of the nitration of cotton must be very carefully maintained and it is this function of viscosity which is the main reason. Formerly it was impossible to make a nitrocotton solution with more than 8/10 ounce of nitrocotton per gallon on account of excessive viscosity. Recently, however, by physical and chemical treatment nitrocotton is produced which will disperse so readily that solutions of twenty to thirty ounces of nitrocotton are quite feasible and common. This was the discovery that opened the automobile and furniture fields to lacquer.

"The resins exhibit the same phenomenon, although to a less extent, as the dispersion of the resin is undoubtedly mor ecomplete than that of the nitrocotton. It is this colloidal state of matter

of lacquer that explains some of its interesting phenomenon, the most striking of which is the tendency of lacquer to blush sometimes in extremely humid weather. This is caused by the evaporation of the solvent and diluent.

"In passing from the liquid to the vapor state they take up heat from the atmosphere immediately above the lacquer film. The air therefore becomes chilled quickly and if it contains any amount of water vapor this water vapor is permeated into the still liquid lacquer film. Water does not have the power to disperse nitrocotton, not only that but it actually neutralizes the dispersing power of the solvent, so that the nitrocotton particles instead of remaining dispersed rapidly come together until as the size of the particles increase it becomes a solid white sheet and precipitates out from the lacquer film giving the whitish blush. This, of course, can be prevented by a slower evaporating solvent which does not take the heat from the air so quickly but allows the air currents to keep air above the lacquer film mixed with the drier air farther above it."

PAPER ON CADMIUM

By W. J. Schneider, New York Branch

MR. W. J. SCHNEIDER: *"History.* The year 1928 is the 100th anniversary of the identification of cadmium as a new metal by Hermann following its discovery in the previous year by Strohmeyer as an impurity in zinc carbonate.

"Occurrence. Several cadmium minerals are known, but none occur in quantities large enough to be called ores. The cadmium of commerce today is all derived from zinc ores in which it occurs on the average to the extent of about one part in 200.

"Production Statistics. The U. S. Geological Survey statistics show that in 1910 the U. S. produced 4,700 lbs. while Germany produced 97,500 lbs. of cadmium. In 1917 these figures were: 217,000 lbs. in the U. S. and 172,000 lbs. in Germany. In 1926 the U. S. produced 810,000 lbs. and the world production was well over a million pounds. Last year the Anaconda Copper Company alone produced approximately 377,000 lbs.

"If all the cadmium were extracted from the world's zinc pro-

duction (about 1,000,000 short tons per year) a production of between 5,000,000 and 10,000,000 pounds of cadmium would be the result.

"If the present rate of increase in cadmium consumption continues it is evident that a shortage of this metal can readily occur within the not distant future.

"You platers will be interested to know that you have been responsible for the rapid increase in cadmium consumption. The plating industry now uses well over half of all the cadmium refined.

"Refining. While formerly cadmium was mostly refined by preferential reduction and fractional distillation from zinc oxide practically all of the American production today is made electrolytically, giving us an unusually high purity product (99.6 — 99.8% Cd) for our anodes.

"In the electrolytic process the cadmium is first recovered from the zinc sulphate solutions by precipitation with zinc dust resulting in a product containing about 20-25% copper, 15-20% cadmium and 30% or more of zinc. This material is then leached with dilute sulphuric acid at about 60 deg. C. When the zinc and cadmium have been dissolved, the solution is filtered and the excess acid removed with limestone. The cadmium is now precipitated chemically on sheet zinc, scraped off, rinsed and again dissolved in dilute sulphuric acid. Cadmium is recovered from this solution electrolytically upon rotating aluminum cathodes using insoluble (lead) anodes. This cadmium is subsequently melted under oil or caustic soda and cast into the sticks of commerce.

"Utility of Cadmium Plate. Electrodeposited cadmium when properly produced has a finish and lustre which gives the product a most pleasing appearance. It plates equally well on cast iron, steel, brass, copper, solder or almost any other metal. The metal deposits rapidly and the bath plates deep recesses unusually well. Cadmium holds its lustre about as well as nickel being superior to zinc in this respect.

"Electrodeposition. The art of cadmium plating is quite an old one, having been patented in England by Russell and Woolrich in 1848. Commercially, however, cadmium plating is still in its infancy since the industrial utilization of cadmium plating has practically all occurred within the past decade.

"One of the first of the present-day workers to pioneer cadmium plating was Emmanuel Blasset, Jr. (The Metal Industry, 9, 509, 1911.) This worker called attention to the utility of cadmium plating and gave directions for its successful commercial execution. His recommendations are as follows:

"Cadmium Plating Bath:

Water	1 gal.
Potassium Cyanide	5 ozs.
Cadmium Sulfate (converted to carbonate)	2 ozs.
Temperature	70° F.
E. M. F.	2 volts
Anodes	Pure Cadmium
Anode Surface	Somewhat less than cathode

"He notes that too large an anode surface or too large a quantity of metal in solution will produce dull gray deposits.

"For straight cadmium plating the Blum & Hogaboom recommendations given below are quite satisfactory:

"Cadmium Oxide	4.2 oz./gal.
Sodium Cyanide	10.0 "

"The use of addition agents is suggested but none are specifically mentioned.

"Temperatures	70 to about 100° F.
Cathode Current Density	5 to 19 A/SF

"The recent wide-spread utilization of cadmium plate on automobile hardware, castors, wash-machine parts, overall buckles and numerous other articles has demonstrated the value of depositing an alloy of cadmium containing a small amount of mercury. These deposits are somewhat harder and finer grained. The control of the bath is simplified through the use of a cadmium-mercury anode which corrodes uniformly and in just the correct amount to keep the bath properly replenished with metal. With these anodes it has been found that the bath improves with use.

"The details of operation of the process are as follows:

"Bath:

Sodium Cyanide 96/98%	7 to 10 oz./gal.
Cadmium Oxide	3 oz./gal.

Caustic Soda or Caustic Potash.....1 oz./gal.
Temperature.....70 to 100° F.
Anodes.....Cadmium-Mercury (98/2%)
Ratio of Anode to Cathode Surface.....2 to 1
E. M. F.....4 to 5 volts
Cathode Current Density.....15 to 30 A/SF

"Auxiliary steel anodes may be used when desirable. The usual cyanide brighteners or addition agents can be used when a bright finish must be produced. In barrel plating the cadmium-mercury anodes furnish all the brightener required.

"Recently cadmium-mercury coatings have also been used with success for the production of a rust-proof antique finish on iron. This finish is produced by dipping the cadmium plated article in a solution containing:

"Water .....1 gal.
Platin-Nig .....¼ to ½ oz./gal.
Muriatic Acid 20° Be.....4 oz./gal.
Temperature .....Normal to 90° C.

"The high lights are relieved and the article is lacquered. Pigment lacquers may, if desired, be substituted for the Platin-Nig dip."

If there are any questions you wish to ask, I shall be pleased to answer them. I did not consider it necessary to display any samples. As I have stated, there are experiences which I found with the various people and firms who have introduced cadmium from a practical point of view and I have tried to relate them. I myself have not been working as a practical man at the art. I though perhaps it would be best to refrain from displaying any samples whatsoever. (Applause.)

MR. MAX LUDWIG: (Chicago): I would like to know how much more rust-proof it is than zinc.

MR. SCHNEIDER: That question can be answered in two ways: in the presence of chlorine or salt it is effective and practically superior to a zinc coating, but in the ordinary atmosphere, as, say, in the inland towns, experience has shown that zinc is equally as good, and much cheaper.

SECRETARY GEHLING: In listening to your remarks about its becoming scarcer in time unless they find some other way of

getting cadmium out of zinc, I understood cadmium was like the mother of zinc and there was only a certain amount of cadmium in a certain quantity of zinc product. The thought occurred that cadmium being a nice white finish and only being about equal as a rust preventative, to zinc, and zinc having a funny color, a dark color, why you fellows who have research work and do research work along that line, do not do something of that sort and try to find why you can't use a certain amount or proportion, the way you find it, with zinc, so as to get a composite deposit and get a good color and a good rust-proof proposition by combining zinc and cadmium together in plating.

There may be a thought there which will come out. You would overcome the evil of the scarcity, if you used the two properties together. Probably you would get a better rust-proof proposition and better color than you do now with zinc alone.

MR. SCHNEIDER: That has been done, but for some reason or other it is a very difficult thing unless it is under chemical control. You are depositing there two metals, and while we have heard that some men were able to continue getting an equalization of these deposits, you know, still it is quite a difficult problem. It is not as easy as brass plating which also consists of alloying. But research along those lines is being done. And furthermore, in answer to your question, we are trying to develop a zinc cyanide that would improve the color, but we think zinc would be equally as good in rust resisting as cadmium, and, being harder than cadmium all one needs is for the men interested in the art to develop some additional agent other than the metal to improve the color of zinc.

MR. DAVID GREENBLATT (Chicago): I would like to know what kind of oxidize is the best thing to stay on cadmium plating so the color will not change.

MR. SCHNEIDER: The formula Platin-Nig reduced with muriatic acid will not fade. You can dip it in there and you get an entire nice black color which can be relieved the same as you would relieve oxidizing of copper and it will stay without lacquer.

MR. GREENBLATT: You have the formula there?

MR. SCHNEIDER: Yes, I have it if anybody wants it.

MR. J. R. KENNEDY (Springfield, Mass.): There is a demand on the market for a black cadmium. I would like to ask Mr.

Schneider if a formula he just mentioned in connection with what this man has said, could be used for black cadmium that would be as hard as white cadmium.

MR. SCHNEIDER: It is quite hard. What I mean to say is that I think the demand is for a high luster on black cadmium and the minute it is dipped in this dip it sort of gives that deader finish rather than a luster finish, but you can dip into this Platin-Nig and get a nice beautiful black on top of your cadmium.

MR. KENNEDY: What I had in mind was something that would be a substitute for something like Parkerizing.

MR. SCHNEIDER: Parkerizing, for your information, is a green gray color when it comes from the solution and then it is afterwards, to bring up the blackness of it, put through a dye in oil. They use subsequent colors for that, but there is a very good lacquer, that is a black lacquer which can be used either with a lustre or a dead finish, first using a binder that a large concern in New York making telephone parts and electrical parts are using quite successfully. It has very good sticking qualities.

MR. KENNEDY: That means another operation.

MR. SCHNEIDER: You wanted it in one? Oh, no, we haven't done anything along those lines. Perhaps some of you men who are research men will develop something that you can get out of the solution. You mean black right in the cadmium. (Assent.)

PRESIDENT FEELEY: Any other questions?

MR. JACOB HAY (Detroit): Did you say a voltage of five there?

MR. SCHNEIDER: Four or five.

MR. HAY: Would you recommend that for plating barrels?

MR. SCHNEIDER: We recommend as high as six.

MR. HAY: I find that you can go as high as fifteen volts in order to get very good results. Now, the cyanide content you mentioned there, ten ounces. Is that correct?

MR. SCHNEIDER: Seven to ten ounces.

MR. HAY: The cyanide content is correct but I believe that by using a higher voltage you get better results in cadmium plating.

MR. SCHNEIDER: Is this in barrel plating? Just to answer your question, there is a gentleman who wrote an article in the Metal Industry this month and his firm is doing tons and tons of

automobile hardware, that is steel hardware such as pull handles, etc., which are plated in the barrel at five to six volts and then fabricated afterwards, I mean bent, and the spring is put in for pulling. They are having no difficulty with that voltage and getting excellent results. It has been done in Connecticut every day now, almost two years.

MR. HAY: I find that in plating springs, you will sometimes notice in cadmium plating, if you go to the trouble that it is brittle. You get to the point where the spring will break.

MR. SCHNEIDER: Is this a high carbon spring you speak of? (Assent.) Don't you think that is due to the excessive current you are using in there?

MR. HAY: It is not the current that is to blame for it. It all depends on the kind of barrel you are using.

MR. SCHNEIDER: I can't go into the different plating barrels but I know some being used they found by cutting down the voltage on the high carbon spring they did not run into that difficulty of getting it too brittle. I attribute that to the high current that one uses.

MR. HAY: I don't think the high current has anything to do with it; we use as high as sixteen volts in the plating barrel.

MR. OSCAR SERVIS (Chicago): I think you will overcome the brittleness of the spring tension, as Mr. Hay stated, by pickling the spring in muriatic acid with an addition of bichromate of potash, and I don't think you will have any trouble no matter what voltage you use. It pacifies the strain.

MR. SCHNEIDER: Men who have plated springs once in a while run into that difficulty but the percentage of bad work is not so great.

MR. JORDAN (Springfield, Mass.): Answering the gentleman about the high tension springs, we had the same complaint in the Bosch Magneto Company. If they have got to be pickled they must be pickled in the chloride, chloride of sulphuric potash. That removes the scale.

I would like to ask the gentleman about cadmium barrels. What makes the residue on a cadmium barrel with the cyanide, depositing crystal on the barrel, the metal depositing on the outside of the barrel. Is it in the solution?

MR. SCHNEIDER: It depends on the hook-up of the barrel it-

self. I think there is a loose current going through there and you get a deposit on the metal parts of the barrel.

MR. JORDAN: Yes, it crystallizes on the outside of the barrel.

MR. SCHNEIDER: You mean in the same way as a nickel solution of salts.

You have to be careful for you will reduce the metal very quickly.

MR. JORDAN: How does cadmium act on prepared tar barrels?

MR. SCHNEIDER: There are a great many barrels on the market that give no trouble whatsoever. Pitch and other linings have a tendency to come away from any cyanide solution in time due to the current generated which gives a temperature around 100 or maybe 110 or something like that, and that will soften the pitch, but they have barrels that are called laminated Bakelite that stand up pretty well. There is a man who has been using a barrel now for eight months without any trouble, and you can't find any reduction of the wood, simply a cypress wood barrel with a support on the sides of the barrel, the same as the spokes of a wheel, like wooden spokes, and he has no difficulty at all with this barrel. That is doing overall buckles and other small things.

MR. WM. GRUND (Bloomington, Ill.): Being with the Elite Corporation for nine years I will speak a few words without advertising; I am with the Meadows now.

Now, in regard to that crystal construction the gentleman speaks of, I deem that to be carbonating. There seems to be a soft film on the outside of the tank. I would say that crystal structure he finds on the inside of the tank, outside of the barrel (you are speaking of the cylinder) is due to carbonates. There is one way to get them out and that is to freeze them out at a temperature down as low as thirty.

Now, so far as the pitch is concerned, there is no difference in plating cadmium in a pitch lined tank or a steel tank or a wood tank. I have plated in all three for the last nine years. We have something like forty-three gallons of cadmium solution in the plant I work in now; some are steel tanks some pitch lined and some wood tanks. The only objection to the wood tank is that in the revolving of the cylinder you pick up a lot of slush from the wood in time which stops up the perforations in the cylinders. Otherwise, as far as any noticeable effect of deposits are con-

cerned, I can't see any difference between wood or steel or pitch lined tanks. I believe that is all I have to say.

MR. LUDWIG: Does the solution work better hot or cold?

MR. SCHNEIDER: We find it better cold, blood temperature.

MR. JORDAN: I see in the brass working industry where they were advertising to heat the cadmium. They claim they have better results.

MR. SCHNEIDER: It is practically a heated solution when it is working in the barrel; if you ever tested that you would find it runs up to 110 sometimes or 115.

MR. WM. H. SCHULTZ (Cleveland): We have a big concern in Cleveland. They work night and day. I get in there occasionally. They have regular coolers around their tank to keep it from getting hot. They absolutely refuse to let it get hot. I think the hot question is out of order.

MR. GRUND: In my experiences with cadmium plating, and I think they have been pretty broad as far as heating the solution is concerned, I do not believe there is an advantage unless you want to plate a certain thickness of coating; whether it is hot or cold makes no difference as far as hardness of deposit is concerned. The only advantage is casting, malleable iron or cast iron.

I will go back a step to this man's question regarding springs. Now, that is the hydrogen part of it I suppose that will crystallize your springs. We had springs sandblasted and they break as easily where sandblasted as where pickled. They way to get away from that is to heat the springs in an oven to a temperature of 175 for about forty-five minutes and that gets away from it.

I cannot agree with the gentleman. I am very, very sorry. I believe it is a misleading statement. Because there isn't a chance under at the very least 300 degrees to get rid of the operation of hydrogen which creates the trouble. I am sorry to hear that statement, it is not true.

MR. GRUND: In answer to that I would say that it depends on the gauge of spring, that is whether it would be a heavy spring or light one. If it is a heavy spring I would say 300 degrees might do the work more easily.

MR. TER DOEST (Akron, O.): I believe cadmium plated wire springs about the thickness of a lead pencil lead can be plated in

about an hour. We have no trouble whatsoever with springs breaking.

MR. J. E. NAGEL (Toledo, O.): This trouble they speak of, high carbon springs. Isn't it true that with any cyanide solution under certain conditions you would have that same trouble on high carbon springs, not only cadmium but copper, zinc or any other solution that is plated out of cyanide on high carbon steel, you will crack the springs under certain conditions, pickling or some other condition; it is not the condition of the plating solution, it is pickling.

MEMBER: We are manufacturing a lamp changer head which reaches high up and in between the two there is a spring. It is a high tension spring, high carbon. These are nickel plated and sometimes they become very rusty. They require more pickling than others. We find that when it takes a longer time to pickle and when they are not heated properly after they are dry, that is during the drying operation after being plated, they break. Now, in other words, the longer you keep them in muriatic acid, if you don't take enough precaution after they are plated, they are going to break. We have found that experience with our process.

MR. KENNEDY: One point has been overlooked with regard to the hot and cold cadmium solution. It is a good deal better to work the cadmium solution cold for this reason, that you don't have the deadly hydro-cyanic acid gas fumes thrown off which are injurious to workmen; if you use a hot one you always have that danger.

MR. GREENBLATT: I had a lot of experience with the springs. We are manufacturing show cases and I had a lot of trouble with the springs. The only way we found to get away with it is sand-blasting. We used to have a lot of trouble but have started to sandblast and haven't had any trouble. We do lots of it.

MR. GRUND: I might say I don't have any trouble with carbonates at all. That might seem funny, but I think if the men using cadmium here will use about a two-thirds area of steel in comparison with the cadmium anode you won't have trouble with crystallization of carbonates. I don't know what you are using, but regardless of what you use, if you try that, you will find that I am right. I have something like forty-three gallons out there and I believe many of you men have been to my plant and if you could find one crystal in that forty-three gallons of solution any time

of year, it would be new to me. I am not speaking from the Ukalite Corporation standpoint any more for I don't work there. They use steel strap about an inch wide; in place of using that I use a four-inch strap of about sixteen gauge steel and put those discs on those, which gives me about two-thirds more area in steel than in cadmium. I think if you try using that you will get away from crystallization of carbonates altogether.

MR. RICHARDS: What about using the steel containers of the anodes—did you try that?

MR. GRUND: You do that when you use the ball but don't get enough area.

PRESIDENT FEELEY: Will you make that question to the floor, please?

MR. RICHARDS: It is a question of using the steel container of the anode as far as shape is concerned the whole interior of the tank, and as to service of insoluble anode is concerned it couldn't be larger. What about that?

MR. GRUND: If you are hooked up directly to the tank, if the anodes are insulated—(interrupted).

MR. RICHARDS: You couldn't be insulated.

MR. GRUND: I am telling you of my success as I have it, I don't know how it would be the other way.

MR. SCHNEIDER: For your information, gentlemen, we have long ago advocated a mixture of steel anodes with our cadmium anodes. Mr. Proctor was one of the first men who advocated the steel, and in connection with our alloyed anodes we have never encountered some of the difficulties that have been brought up here this afternoon. I have never yet in any of the solutions I have observed witnessed any excess of carbonates or crystals unless it is due, as I said before, to an excess of metal which reduces very readily from the anode and it is not controlled correctly. Otherwise you will never run into the difficulty.

PRESIDENT FEELEY: Our first paper this morning gentlemen and ladies of the Educational Session is a paper on Cadmium versus Zinc, and I would ask Mr. Hogaboom to kindly read the paper to you.

MR. HOGABOOM: "Cadmium and zinc are, as you know, both extensively used for the protection of iron and steel against cor-

rosion. Cadmium and zinc greatly resemble each other, therefore solutions and operating conditions now in use for deposition these metals are very similar. In at least one respect zinc has the advantage over cadmium, it is cheaper than cadmium.

"In presenting this paper on the above subject, I will just consider the type of solutions for plating these metals, now in use at our plant. The results obtained by us with respect to both cost and production will enable you to judge which of the two metals is the most economical to use and which will give the maximum protection to iron or steel.

"Recently we cadmium plated 78,000 bolts and nuts for a large concern to be used in connection with an oil refinery on the east coast of Canada. The following are the particulars of the operations and costs: thickness of deposit, .0004 capacity of tank, 300 gallons; weight of each load, 50 lbs.; current density (approx.) 20 amperes per sq. ft.; time to plating, 15 minutes; numbers of loads per nine hours, thirty-four; weight of bolts and nuts plated each nine hours, 1700 lbs.; price obtained per 100 lbs., $2.75; earnings per nine-hour day, $46.75; labor per nine-hour day, $5.40; total earnings per nine hours, $41.35.

"A short time previous to the above we ran a similar order for another concern, but the specifications read electro-galvanize. The following are the particulars of operation and costs: thickness of deposit, .0004 in.; capacity of tank, 300 gallons; weight of each load, 50 lbs.; current density (approx.) 20 amperes per sq. ft.; time of plating, 40 minutes; number of loads per nine hours, thirteen; total weight plated per nine hours, 650 lbs.; price per 100 lbs., $2.50; earnings per nine-hour day, $16.25; labor costs per nine-hour day, $5.40; total earnings per nine hours, $12.85.

"The total weight of each job was approximately 4,000 lbs. The cadmium plating job was completed in twenty-two hours at a cost of $13.50 for labor; the zinc plating job was completed in fifty-five hours at a cost of $31 for labor. The price obtained for the cadmium job, $110, labor $13.50, net $96.50; the price obtained for the zinc job, $100, labor $31, net $69.00, showing an advantage for Cd of $27.50.

"But when you come to consider that the cadmium plating equipment solutions and anodes cost about ten times that of the zinc plating equipment it cuts down the advantage gained in de-

positing the cadmium faster. The type of zinc solution used by us is of the cheapest kind and the anodes cost only 11½ cents per lb. At the time we installed the cadmium plating equipment cadmium anodes sold for around eighty cents per pound. The zinc solution is practically self-sustaining, while the cadmium solution requires an addition of sodium cyanide (2 lbs. per 300 gallons of solution daily) when in constant use. Of the two metals zinc is much harder, it is also more difficult to finish with a lustrous surface. The throwing power of cadmium solution is very good, that of zinc solution is poor. The protective value of cadmium is very high as is also the protective value of zinc. Both metals lose much of their protective values when nickel or copper is deposited over them on an iron or steel base. This we have proved by many tests and in actual service on automobile parts such as shells and bumpers. Cadmium can be plated over with almost any metal without difficulty, zinc is more difficult to plate over except in special solutions. Having no salt spray equipment we use two methods which are as near to the treatment the plated products are likely to be subjected to as we know of.

"The first method is to immerse the parts in sea water for nine hours, then removes them for seventeen hours and repeat until the deposit breaks down. It is really surprising the amount of immersion that cadmium plated ship spikes will stand, we have some that have been subjected to the above treatment since January 18, 1928, and still show no signs of breaking down.

"The second test is an atmospheric test which consists of hanging the parts to be treated out in the weather, touching nothing. These parts are inspected every day and a record of conditions is kept. I might add at this point that we are located directly on the eastern sea shore of Canada and at times have heavy sea fogs or mists that are full of sea salt and extend along the coast, and inland for a distance of forty miles. The result of these sea fogs you can readily imagine. I am not exaggerating when I tell you that ordinary wire used on chicken runs, etc., lasts only about six months, and I have picked off large pieces of rust about one-eighth inch thick for stay rods that were not protected by paint or plating. Ordinary shingle nails simply dissolve in this air and consequently the builders use zinc or cadmium plated nails, or copper nails. Ship builders are using cadmium plated ship spikes instead of copper spikes as formerly used.

"The demand for protection against the great enemy, rust, is very general, the field is distinct and large.

"Most of the work we do in the line of ships hardware and fittings drift bolts for piers and harbor work, bolts, nuts, rivets and washers, railroad spikes, hinges, pulley blocks and nails, are plated with cadmium which has almost entirely eliminated zinc from the plating industries of the Province of Nova Scotia and it is giving the greatest satisfaction.

"Sea water tests on cadmium and zinc deposits reveal the inferiority of zinc as follows:

Test No. 1	.0004"	Drift bolts ¾" × 12", electro galvanized. Eleven immersions or 99 hours — rust under the head
		Drift bolts ¾" × 12", cadmium plated, 17 immersions or 153 hours — no sign of rust
Zinc	Deposit .0004" thick	Hanging in air one year and 5 months, no rust
Cadmium		Hanging in air one year and 5 months, no rust

"These tests are about the average and the results are nearly always the same, cadmium having the advantage over zinc in sea water.

"We find that cadmium is more in demand than zinc in our line of work. It is one of the best protectors of iron or steel against rust. It is very easy to deposit upon steel or iron, it gives better protection than zinc plating on articles exposed to sea water, and owing to the faster rate of deposition; cadmium can be used to good advantage where there is a distinct field for its use and the volume of work justifies the expenditure of more money for equipment. I do not wish to infer that cadmium can be deposited less expensively than zinc but I do contend that it can be deposited as cheaply if you have the volume of work owing to the higher rate of deposition and the price obtained for the work done. I might add that since we installed our cadmium plating equipment two and one-half years ago it has been in constant use, has given no trouble and is operated under consistent chemical and electrical control." (Applause.)

PRESIDENT FEELEY: As the author is not present, I do not believe we can do very much with discussion.

MR. HOGABOOM: There is one point of that paper which is of interest. It stated that plating cadmium that is to be used for coil—we would like to learn if any of the members present have had a similar experience. We know of two cases where cadmium has come in contact with oil or gasoline which has had a high sulphur content. In both cases there has been a precipitation occur. This has been analyzed by some chemists of a large oil industry and identified as cadmium sulphide.

It looks as if cadmium, while it may be used with some oil products, that there is a likelihood of its breaking down if used in oil or gasoline that has a high sulphur content. I would like to hear an expression of opinion, if possible.

PHILADELPHIA BRANCH

January meeting of the Philadelphia Branch was held on the 11th inst. with Vice President Lunbeck in the chair.

The secretary announced the death of our fellow member, C. F. Harbster, on December 25th, 1928, and reported that he had extended the sympathy of the branch to the family.

Four applications were presented and accepted for investigation. Mr. Graham outlined the information the Hogaboom-Sizelove research committee wanted to create some real plating solution.

J. E. Eddows was the speaker of the evening who gave an interesting talk of his experience in entering the plating craft and showed sample of nickel and cadmium plated parts of a recording machine. At the conclusion of his talk Mr. Eddows was given the usual vote of thanks.

Philip Uhl, Sec'y.

PITTSBURGH BRANCH

Report of Meeting Held Feb. 2nd, 1929

Our meeting of Feb. 2nd was not as well attended as it should have been, for we had one of our own members as the speaker of the evening. Mr. T. P. Thomas, research chemist of the Westinghouse Electric and Mfg. Co., spoke upon the electro-deposition of iron as carried on at their plants. Mr. Thomas spoke for over an hour and presented many samples of the work done upon worn motor shafts and this deposit proved very satisfactory as it may be bent or forged to suit the requirements. This talk and discussion that followed was most interesting.

We were very sorry to report the death of one of our valued members, one who had been an honorary member since the founding of the Pittsburgh Branch, Mr. Jesse L. Jones, chief chemist of the Westinghouse Electric & Mfg. Co. Not only our branch, but the whole society will miss Mr. Jones.

S. E. Hedden, Sec'y-Treas.

ANNUAL EDUCATIONAL SESSION CHICAGO BRANCH AMERICAN ELECTRO-PLATERS SOCIETY

Crystal Room, Hotel Sherman

Chicago, Ill., January 26, 1929

The meeting of the Chicago Branch of the American Electro-Platers' Society in Annual Educational Session was opened by the Librarian, Oscar E. Servis, at two p. m.

In attendance at the meeting were 325 men, including many manufacturers, superintendents, chemists and others interested in the electrodeposition of metals, as well as members of our society.

Our President, Robert Meyers, welcomed our members, guests and friends in a few well chosen words.

Professor Edwin M. Baker, Michigan University, Honorary Member Milwaukee Branch A. E. S., was the first speaker introduced by the Librarian. Professor Baker's topic was "The Future of Chromium." With lantern slides and charts he proceeded to show the results of many tests upon many types and thicknesses of chromium on different base metals and undercoatings as to the durability, usefulness and appearance of the chromium plate. He concluded his remarks by stating that the future of chromium depends upon the platers upholding the quality of the deposits of chromium on the goods to be used by the public.

The Librarian opened the meeting to discussion on Prof. Baker's paper. The following questions and answers comprise the discussion:

Q. Has chromium come to stay?

A. Yes. The quality of one-half the chromium plate is very substantial.

Q. What is considered a good chromium deposit?

A. A deposit that is rust-resisting to weather 1½ years, or to rubbing and washing 3 years. Such a deposit requires from 300 ampere-minutes to 600 ampere-minutes.

Q. Is a chromium deposit direct on brass satisfactory?

A. It is not economically satisfactory. In wet weather it does not hold, but in dry weather it might last.

Q. Does this pertain to red as well as yellow brass?

A. Results show chromium deposits direct on yellow brass as poor, on red brass as intermediate and none too good, but very good on copper.

Q. Is the use of a copper or nickel strike on brass sufficient before a chromium deposit?

A. A nickel strike is better, but hard to get adherence of the nickel flash on yellow brass.

(All above answers made by Prof. Baker.)

At this point Mr. Sohn suggested that he would be touching on the matter of chromium deposits on brass in his paper and questions on this point might be deferred until after his paper. No further questions were asked.

Charles H. Proctor, founder of our society, was the next speaker,

reading a paper on "The Modern Methods of Deposition of Tin." This paper is attached to these minutes, marked Exhibit "A." At the conclusion of Mr. Proctor's paper the meeting was again thrown to questions with the following question, answered by Mr. Proctor.

Q. In the water chamber of a water meter the surface is subjected to wear of a hard rubber part. Is it better to have a nickel deposit under the tin deposit?

A. Yes, it is better to use nickel under tin when the surface is subject to friction.

Mr. Proctor then passed around several samples of tin deposits, which were eagerly examined.

Mr. Erwin Sohn, Research Director, Standard Sanitary Company, member of Pittsburgh Branch, was the next speaker. "Impromptu Remarks on Chromium Plating." In the course of his paper Mr. Sohn brought out the point that too high a sulphate content in the chromium bath wastes current and makes poor deposits with many cracks in the deposits.

Following Mr. Sohn's paper it was suggested that further discussion be withheld until after all the papers on chromium had been read. The Librarian accepted the suggestion in view of the limited time remaining for the papers yet to be read.

Dr. Oliver P. Watts, Wisconsin University, Honorary Member, Supreme Society A. E. S., discussed the theory of chromium plating, in many points touching upon the practical applications of the theory. He mentioned the use of hydrochloric acid with 2 per cent of formalin by volume for the stripping of chromium from steel. Among the interesting things he mentioned was the adaptation of the old nickel "doctor" to chromium work. He suggested the use of asbestos cording in wrapping the lead anode, and that the work being "touched up" be kept warm.

Mr. McCord of the Detroit Branch A. E. S. gave an interesting account of the plans that are in the making to make the next annual meeting of the society the finest yet held. The date for the meeting is set for July 8, 9, 10 and 11, 1929, at Detroit, Mich.

The Librarian announced that the annual Educational Session of the Milwaukee Branch A. E. S. will be held at the Hotel Schroeder, Milwaukee, Wis., on April 6th, 1929.

Mr. Jacob Hay, C. M. Hall Lamp Co., Detroit, Mich., also past president of Chicago Branch, read a paper on "The Truth About Chromium," which is hereto attached and marked Exhibit "B."

Discussion of chromium plating followed, with the following questions and answers that were made audibly to all assembled in the meeting.

Q. What is a good test of corrosion of Chromium plate upon nickel plate upon a base metal aluminum?

A. (By Prof. Baker). Write to Dr. Work of Mellon Institute, who is doing work along these lines.

Q. Is it advisable to cover racks in chromium-plating, and if so, with what material?

A. (By Mr. Hay) The use of rubber is not advisable as the chromic acid attacks the rubber and spoils the bath. Proper racks will not need covering.

A. (?) A stop-off lacquer, orange color, manufactured by various lacquer firms, was recommended by one man.

There being no further questions directed to the chairman, the librarian declared the Educational Session adjourned at 6:12 p. m.

HAROLD W. FAINT,
Acting Secretary, Educational Meeting.

ROCHESTER BRANCH

Rochester Branch met at Powers Hotel, January 18th, and their educational feature was Nickel Solutions which were discussed, to be continued at February meeting.

Rochester will hold their annual banquet at Powers Hotel, Saturday, April 13th, with an educational session in the afternoon and the banquet and entertainment and dancing in the evening.

The following committee will have charge: Mr. Chas. Griffin, Mr. S. P. Gartland, Mr. Clarence Reama, Mr. Raymond Lopez, Mr. William Hart, Mr. John Snyder and Mr. Eli Beaudry.

Rochester Branch invites you to be with us at this time. **Don't forget —April 13th.**

Chas. Griffin, Secy.

HARTFORD-CONNECTICUT VALLEY BRANCH

Hartford, Conn., Valley Branch, A. E. S., held its monthly meeting at the Hartford Chamber of Commerce, 805 Main St., Hartford, Conn., Monday evening, January 28, 1929, at 8:30 p. m.

The meeting was called to order at 8:30 p. m. with President Elwin in the chair. Minutes of the previous meeting were read and approved. All bills to date were ordered paid. Two applications were received and voted upon for publication.

There was much discussion in regards to our annual banquet to be held some time in May. It was also voted to hold our February meeting in Meriden instead of Springfield. President Elwin and Mr. Stephenson to find a speaker and also a meeting place.

Business being concluded, Mr. Robert Stevens, chemist of the Holmes & Edwards Mfg. Co. of Bridgeport, Conn., was introduced and gave a very interesting talk on "Silver Plating." His talk was enjoyed by all, and he also answered the many questions asked in connection to his talk. In conclusion he was given a rising vote of thanks.

The meeting was attended by only twelve members and visitors and was adjourned at 10:30 p. m. Vernon E. Grant, Sec'y.

A. E. S. PAGE

Assembled Expert Scraps With and Without Significance

Pres. H. H. Smith's favorite song—Pneumonia.

Geo. B. Hogaboom only needs a place to go on Xmas and New Year's days and his family won't know him.

Clever Comeback

The story is told of an Irishman boarding a crowded transit car and finding a dog occupying a seat.

"Sure an' tis an outrage that I should pay a nickel and shtand while thet dorg has a seat."

The conductor obligingly asked the owner to remove the cause of trouble, and the Irishman sat down well pleased.

"Foine dorg that is," he complacently remarked to the owner—"Av what breed may it be?"

"It is a cross between an ape and an Irishman," remarked the owner.

"Sure then an it must be related to both of us," retorted the Irishman.

Pairable

Bridegroom—Parson, this lady is to be my future wife.

Parson—Pleased to mate you.

Chas. Proctor is sure getting to be perpetual motion. Still going strong and traveling.

The justice of peace is the only peace connected with some matrimonial experiences.

When a woman wears her new hat to church for the first time she wonders why the sermon was short.

No Sentiment

The young husband dashed into the office very late one morning shouting, "I'm a father! I'm a father!"

The Big Boss looked at the clock disgustedly and replied, "So's your old man. Get to work."

A. E. S. PAGE

Men get pearls from oysters but women get diamonds from nuts.

"Make a sentence with the word 'token' in it."

"Token live as cheap as one."

Money is called cold cash because we don't keep it long enough to get warm.

You can never tell from where you sit how far a dill pickle will squirt.

NEWARK BRANCH

Newark Branch held an open meeting on Friday, Jan. 18, 1929, with 63 members and visitors present, President Geo. Wagner opened the meeting and in well chosen words welcomed those present. A large delegation from New York Branch attended.

The speaker of the evening was Mr. L. Graham of the Connecticut Dynamo & Motor Co., taking for his topic, "Chromium Equipment," and describing the method of installing the tank with proper insulation and heating accessories. Generators and wiring was also included in the talk. A rising vote of thanks was given Mr. Graham for his instructive and interesting talk.

Messrs. Gehling and Sizelove spoke on the chromium plating of die castings.

Mr. Wm. Voss of New York Branch spoke on the plating of die castings in barrels.

Meeting adjourned at 10:30 p. m. and all were invited to partake of refreshments provided by the entertainment committee.

Our Feb. 1st meeting was held in Franklin Hall with an attendance of 22. President George J. Wagner presided. Minutes of previous meeting were approved as read.

Three applications were read and ordered to take the regular course.

Mr. Smith gave a report on the progress of the banquet committee. The banquet will be held at the Elks Home, 1048 Broad St., Newark, on Saturday, April 6.

Mr. Sizelove gave a report on the Baltimore banquet. Cadmium solutions and their addition agents were discussed.

Royal F. Clark, Sec'y-Treas.

LOS ANGELES BRANCH (Temporary)

A temporary Los Angeles Branch of the American Electroplaters Society held their meeting at the Y. M. C. A., at which 24 names were signed to application for the Charter.

A very interesting meeting followed at which papers were read on Cadmium Plating and Plating on Aluminum. Both were enjoyed and a lively discussion followed.

Yours very truly,

M. D. Rynkofs, Sec. & Treas.

1354 W. 25th St., Los Angeles, Calif.

CLEVELAND BRANCH

Cleveland Branch had a very enthusiastic meeting February 2, 1929, and the subject was Hazards in the Plating Shop, from a paper by Dr. W. A. Evans, and from the discussion that followed it must be a subject that everyone is interested in and it brought out the following from our members:

Mr. Thompson, Moss oil of Salt and also Ichthyol Ointment, and by Mr. Smith, soak the affected parts for 10 or 15 minutes in a soft soap made with Ivory soap or Palmolive soap as hot as you can stand it. Mr. Mullinnix also says that Murphy's oil soap thickened with corn meal used the same way will also take out the soreness. Also, Linseed oil soap would do the same. It was suggested that eating oranges was a good preventive.

We hope to have another good meeting in March.

H. J. TerDoest, Secy.

BRIDGEPORT BRANCH

Meeting opened at 8:30 o'clock. The roll call of officers was read. Three officers were absent. Application of Mr. Duncombe was read, and it was voted that it take its usual course. Communications were read and we have another tenant added to our rooms which brings our rent down to a very low sum. It was voted to give Mr. Straton a vote of thanks for getting the tenants.

Our banquet will be held very soon so the chair selected members to act on the committee. The following members were selected: Ray O'Connor, chairman; Wm. Stratton, Wm. Flaherty, John C. Oberender, S. Karl, B. Husterer and Wm. Thompson. They have set the date for April 20, 1929, so we hope that all hands will be on deck for this annual occasion.

Nothing further to come before the meeting, so a motion to adjourn was passed. Meeting closed at 10 o'clock.

Wm. Ehrencrona, Secy.

TORONTO BRANCH

The regular monthly meeting was held on January 28th, at the Canadian Foresters' Hall, 22 College Street. President J. Walker called meeting to order at 8:30. Mr. Geo. B. Hogaboom, who was present to deliver an illustrated lecture, was then introduced. Prof. J. T. Burt-Gerrans, University of Toronto, who is an honorary member of the Toronto Branch, kindly assisted Mr. Hogaboom at the lantern. A number of the metal finishing concerns were represented and members, making a splendid attendance.

The lecture was one that will not be forgotten for a long time. It dealt with "The Structure of Metals and Its Effect Upon Plating Results," which proved that the plater's troubles were not entirely due to his solutions. There were 68 slides which beautifully illustrated the crystal structure of the metals before and after plating, also corrosion of anodes.

After the lecture, discussions on other phrases of electro deposition proved very interesting. Meeting was closed with a hearty vote of thanks extended to Mr. Hogaboom and Prof. Burt-Gerrans for the instructive lecture enjoyed by all. Members of the Toronto Branch hope to have another evening of this kind in the near future and sincerely appreciate the kindness of Mr. Hogaboom for coming to Toronto and favoring them on this occasion.

W. J. Sutherland, Sec.-Treas.

CHICAGO BRANCH

Regular monthly meeting of Chicago Branch held at Atlantic Hotel, Feb. 9th, 1929.

Meeting called to order, President Robt. Meyers presiding. There was a very good attendance.

The banquet committee reported the attendance at the annual banquet was the largest in the history of Chicago Branch. Also the educational session was the most interesting.

After the regular order of business was completed the meeting was conducted by the Librarian.

Mr. H. Faint again delivered a lecture in the chemical class which was appreciated by all. Those members that are not attending the meetings are surely missing a treat. After the lecture was completed the Librarian found the following questions in the question box:

Question 1. What is the reason for a copper cyanide solution to plate in light and dark streaks. The anodes will not brighten up.

Answer 1. It was thought that too much hyposulphite of soda was used.

Question 2. What causes chromium deposit to turn a blue color when it goes through hot water and is dried up, which makes it necessary to color buff all parts?

Answer 2. It was suggested to use a soda bath after the first rinse.

Question 3. Is it necessary to lead line steel tank for chromium plating before glass lining is put in?

Answer 3. Lead lining was suggested best.

Question 4. What is a good bright dip for steel? The articles should come out of the dip clean and bright.

Answer 4. 1 quart sulphuric acid, 1 gallon water, ¾ pound sulphate zinc or make up bright dip and use only for steel, also use nitric acid rinse and follow up in dip containing 50 per cent muriatic acid. Nitre cake was also suggested.

Question 5. What is a formula for packerizing and how is it done?

Answer 5. 4 ounces phosphoric acid, 1 gallon water with the use of cast iron chips solution. Should be boiled 12 to 24 hours.

Question 6. How can anodes be kept clean in a bronze solution which is run all day at a temperature of 90° F? Anodes are rolled copper.

Answer 6. Lack of cyanide.

Question 7. Can anything else be used besides hyposulphite of soda for brightning copper solution?

Answer 7. Liver of sulphur added in small amounts.

Question 8. How can Tri Valent chromium be removed out of chrome solution. Is an accumulation of same detriment to chrome plating?

Answer 8. Electrolyzing through porous cup per method mentioned in Dr. Luken's talk to Philadelphia Branch, published in Quaker City Reminder.

There being no further business, meeting adjourned at 10:30 p. m.

Samuel Trapp, Sec'y.

MILWAUKEE BRANCH

The annual banquet and educational meeting of Milwaukee Branch will be held April 6, 1929, at the Schroder Hotel, and the committee in charge. Invite you all to be present and enjoy best educational meeting of the year, in charge of R. Goodsell.

The social end of this meeting will be on a par with previous ones, held by this branch, and we assure you that some new and novel features will be had, so come and stay if necessary a night and a day.

DAN. WITTIG.

PHILADELPHIA BRANCH

The Quaker City Platers Reminder is one year old today, we have learned that such a letter to be successful must have a mission and a story to tell, therefore we are starting volume No. 2 with a cartoon and a story.

Let us not start 1929 like the fellow in the picture with our nose always on the grindstone. How can one get away from the daily grind? In the way of a suggestion, attend the classes at the Evening Kensington High School and also all the branch meetings at the Harrison Laboratory each month and that way keep up to the minute with your problems, thereby giving you more time to see other things.

At the Evening High School we have the use of two laboratories and with the full enthusiasm and initiative of you members we could conduct the best course in Electroplating Chemistry in the A. E. S., for it affords the opportunity for individual work in chemistry, and aside from the analysis of solutions, the resistivity, anode and cathode polarization may be measured with a Haring Box, and the use of the potentiometer may also be mastered.

All our members with the enthusiasm and a desire for knowledge and living in or near the city should avail themselves of this opportunity.

In following the progress of the Newark Branch's class in the Vocational Evening School under the leadership of Mr. Oliver Sizelove, two of the members of the Advanced Class are now able to relieve Mr. Sizelove of instructing the Elementary Class, thereby giving Mr. Sizelove more time to devote to the interests of the Advanced Class and which has proven out very successful, and what can be done by platers in Newark can also be done by the platers in Philadelphia,

so let's take our hats off to the Past, and take our coats off to the Future and get busy.

The story that the Reminder has to tell is your story as told by the speaker at each monthly meeting at the Harrison Laboratory and the knowledge and experience gained at these meetings all go to help the plater in his daily problems.

Now let your New Year's resolution be to get away from the grindstone, and come out and attend the meetings and mix in with the live ones so that the next year will still be a better year than the past.

Al. Hirsch, Editor.

APPLICATIONS

	Branch
Harry J. Maurer, 81 Rich St., Irvington, N. J.	Newark
Edward Baurer, 1198 Long Ave., Hillside, N. J.	Newark
Chas. Renter, 27 North 5th St., Newark, N. J.	Newark
Harold R. Smallman, 28 Middlesex St., Matawan, N. J.	Newark
Harry J. Maurer, 81 Rich St., Irvington, N. J.	Newark
Edward Bauer, 1198 Long Ave., Hillside, N. J.	Newark
George A. Barker, c/o Eagle Lock Co., Terryville, Conn.	Hart, Conn. Valley
Jos. Pietro, Jr., c/o Horton Mfg. Co., Bristol Conn.	Hart, Conn. Valley
Louis M. Hague, 1533 Valmont St., Pittsburgh, Pa.	Pittsburgh
Peter Pitts, 3338 N. Oakley Ave., Chicago, Ill.	Chicago
Herbert G. Pahlow, 339 Selden St., Galesburgh, Ill.	Chicago
Mr. Duncombe	Bridgeport

ELECTIONS

	Branch
H. Leroy Beaver, 7106 Wayne Ave., Upper Darby P. C., Pa.	Phila.
Theodore D. Gaul, 440 Woodward St., Reading, Pa.	Philadelphia
Fred E. Snyder, 524 N. 10th St., Allentown, Pa.	Philadelphia
Geo. M. Shapel, 222 S. 4th St., Hamburg, Pa.	Philadelphia
H. R. Willis, 1406 Vance Ave., Coraopolis, Pa.	Pittsburgh
Frank P. Romanoff, 125 N. Keeler Ave., Chicago	Chicago
Adolph B. Gork, 1520 Price St., Rockford, Ill.	Chicago
James Melican, 4 Denny St., Worcester, Mass.	Worcester
Roscoe W. Rice, c/o Hayes Wheels & Forgings Ltd., Chatham, Ont., Can.	Detroit
Harry Burke, Garland, A. A. County, Md.	Baltimore-Washington
Wm. R. Mullikin, 1341 N. Patterson Park Ave., Butte, Md.	Baltimore-Washington
Wm. A. Fallen, 77 Warral Ave., Bridgeport, Conn.	Bridgeport
Frank W. Burman, 3303 Beverly Rd., Baltimore, Md.	Baltimore-Washington

SUSPENSIONS

	Branch
H. B. Farrand	Philadelphia

DEATHS

	Branch
C. F. Harbster	Philadelphia
Jesse L. Jones (Honorary)	Pittsburgh

BALTIMORE-WASHINGTON

Meets in Enoch Pratt Library, Calhoun and Hollins Sts. Geo. F. Turner, Secretary, Baltimore, Md.

BOSTON

Platers' Supply Co., 202 Friend St., Boston. Secretary, A. W. Garrett, 45 King St., Dorchester, Mass.

BRIDGEPORT

Meets first and third Friday of each month at 62 Cannon St., Room 17, Bridgeport, Conn. Secretary, Wm. Ehrencrona, 872 Hancock Ave., Bridgeport, Conn.

CHICAGO

Meets second Saturday of each month, at 8 p. m., Atlantic Hotel, 316 S. Clark St. Secretary, S. J. C. Trapp, 1127 N. 7th St., Maywood, Ill.

CINCINNATI

Meets every Thursday, 7:30 p. m., at Vocational Training School, Spring and Liberty St. Secretary, Al. Yeager, 2021 Sherman Ave., Norwood, Ohio.

CLEVELAND

Meets first Saturday of each month at Hotel Winton. H. Terdoest, 414 Pioneer Ave., Akron, Ohio.

HARTFORD-CONN. VALLEY

Meets fourth Monday in each month alternately at 266 Pearl St., Hartford, Conn., and corner Broadway and Worthington St., Springfield. Secretary, Vernon Grant, 43 Putnam St., Bristol, Conn.

DAYTON

Meets first Saturday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Robert G. Suman, 2734 Ridge Road, Dayton, Ohio.

DETROIT

Meets the first Friday of each month at the Hotel Statler, Louis II Room, Detroit. Secretary, Chas. Phillips, 13421 Camden Ave., Detroit, Mich.

GRAND RAPIDS

Meets on the second Saturday of each month at the Vocational High School, 129 Bostwick Ave., N. E. Secretary, Jacob Van Dyke, 1361 Union Ave., N. E., Grand Rapids, Mich.

INDIANAPOLIS

Meets the second Saturday of each month at Hotel Denison. Secretary, Louis Mertz, 1725 Union St., Indianapolis, Ind.

MILWAUKEE

Meets second and fourth Thursdays of each month at Cor. 3rd St. and Highland Ave. J. N. Hock, 1229 W. 24th St., Milwaukee, Wis.

MONTREAL

Meets last Friday of month at Office of Secretary, John H. Feelay, 411 Aylmer St., Quebec, Canada.

NEWARK

Meets first and third Fridays of each month at Franklin Hall, 41 Franklin St., Newark, N. J., at 8 p. m. Secretary-Treasurer, Royal F. Clark, P. O. Box 201, Newark, N. J.

NEW YORK

Meets every second and fourth Fridays of each month in the World Building, Park Row, New York City, N. Y. Secretary, R. J. Liquori, 2439 Hubbard St., Brooklyn, N. Y.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, P. Uhl, 2432 North 29th St., Philadelphia, Pa.

PITTSBURGH

Meets first Friday of each month at 8 p. m., at downtown branch, Y. M. C. A. Secretary, S. E. Hedden, 227 Fifth St., Aspinwall, Pa.

PROVIDENCE-ATTLEBORO

Meets first and third Thursday of each month at 44 Washington St., Prov. Engineers Rooms, Providence, R. I. Secretary, J. H. Andrews, 19 Rosedale St., Providence, R. I.

ROCHESTER

Meets every third Friday of each month at the Powers Hotel. Secretary, Chas. Griffin, 24 Garson Ave., Rochester, N. Y.

ST. LOUIS

Meets second Friday of each month at Central Y. M. C. A., 16th and Locust St. Secretary, C. T. McGinley, 8214 Fairham Ave., University City, Mo.

TOLEDO

Meets first Thursday of each month at Toledo Secor Hotel, corner Cherry and Page Sts. Secretary, W. W. Welker, 2228 Middlesex Rd., Route 2, Box 635, Toledo, Ohio.

TORONTO

Meets fourth Monday of each month at Canadian Foresters' Hall, 22 College St., Room No. 2. Secretary, W. J. Sutherland, 197 Gillard Ave., Toronto, 6, Canada.

WATERBURY

Meets every second and fourth Thursday of each month. Secretary, Wm. F. Guilfoile, Garden Theatre Bldg., East Main St., Waterbury, Conn.

WORCESTER

Meets Directors' Room, Chamber of Commerce, Worcester, Mass. Roger H. Bryant, Secretary.